Having thus described the preferred embodiments, the invention is now claimed to be:

1. An apparatus for diagnostic imaging comprising:

a first memory means **(14)** for storing a first diagnostic image;

a second memory means **(18)** for storing a second diagnostic image;

a means **(20)** for automatically registering the first and second diagnostic images from the first and second image memories without operator assistance;

a means **(104, 22)** for concurrently displaying a corresponding pair of slices of the first and second registered diagnostic images; and

a means **(102)** for concurrently stepping the displayed slice pair corresponding through the first and second registered images.

2. The apparatus as set forth in claim 1, wherein the registering means **(20)** includes:

a means **(50)** for determining an affine transform representative of misalignment of the first and second diagnostic images; and

a means **(90)** for operating on one of the first and second diagnostic images in accordance with the determined affine transform to register the first and second images.

3. The apparatus as set forth in claim 2, wherein the affine transform determining means **(50)** includes:

a means **(54)** for matching pairs of points in the first and second diagnostic images;

a means **(58)** for determining differences between locations and surface normals of the matched points; and

a means **(70)** for determining an affine transform which minimizes the deviation between the locations of the matched points.

4. The apparatus as set forth in claim 3, wherein the point matching means **(54)** includes:

a processing means **(56)** which implements a K-D tree matching algorithm.

5. The apparatus as set forth in claim 4, wherein the deviation minimizing means (70) includes:

a processor (72) which performs a Levenberg-Marquardt error minimization algorithm.

6. The apparatus as set forth in claim 3, wherein the affine transform means (50) further includes:

a means (52) for selecting a reduced fraction of points to be matched in the first and second registered images.

7. The apparatus as set forth in claim 6, further including:

a means (60) for removing matched pairs of points which fail to meet preselected criteria.

8. The apparatus as set forth in claim 3, further including:

a selectively non-uniform random number of point reducing means (52), which reduces a number of points by one of selectively using prior knowledge and randomly while oversampling points for optimizing registration along a direction in which the stepping means (102) steps the slice pairs.

9. The apparatus as set forth in claim 3, wherein the registering means (20) further includes:

a means (24) for converting the first and second diagnostic images into feature image representations, the affine transform determining means (50) operating on the first and second features representations to determine the affine transform.

10. The apparatus a set forth in claim 9, wherein the features generating means (24) includes:

a segmentation means (26), which segments appropriate target organs in the diagnostic images; and

a feature extraction means (34) that extracts a set of features to be matched in the diagnostic images.

11. The apparatus as set forth in claim 10, wherein the features image generating means (24) includes:

a thresholding segmentation means (26), which segments lungs in the diagnostic images using a predetermined threshold and the features defined as the surface points of the lungs extracted by assigning a tissue on one side of a boundary of an organ of interest a first value and a tissue or air on another side of the boundary of the organ of interest a second value, distinct from the first value; and

a means (28) for extracting a boundary layer of voxels of the first value which adjoin voxels of the second value.

12. The apparatus as set forth in claim 11, further including:

a scaling means (40) for scaling the boundary layers of the two images; and

a normalizing means (42) for normalizing the boundary layers, prior to the surface images being operated on by the affine transform means (50).

13. The apparatus as set forth in claim 9, wherein the affine transform determining means (50) further includes:

a transform processor (82), which operates on one of the feature images with the determined affine transform to facilitate iterative operation of the affine transform determining means to optimize the affine transform.

14. The apparatus as set forth in claim 3, further including:

a means (106) for combining an operator selected plurality of slices in each of the displayed slice images.

15. The apparatus as set forth in claim 3, further including:

a diagnostic imaging apparatus (10) connected with the first memory means (14) for generating the first diagnostic image representation of a region of interest of a patient; and

an archive means (16), from which the second image representation of the volume of interest of the patient taken at an earlier time is withdrawn and loaded into the second memory means (18).

16. A method of diagnostic imaging comprising:

storing a first diagnostic image;

storing a second diagnostic image;

automatically registering the first and second diagnostic images without operator assistance;

concurrently displaying a corresponding pair of slices of the first and second registered diagnostic images; and

concurrently stepping the displayed slice pair to corresponding regions of the first and second images.

17. The method as set forth in claim 16, wherein the step of registering includes:

determining an affine transform representative of misalignment of the first and second diagnostic images; and

operating on one of the first and second diagnostic images in accordance with the determined affine transform to register the first and second images.

18. The method as set forth in claim 17, wherein the step of determining the affine transform includes:

matching pairs of points in the first and second diagnostic images;

determining differences between locations and surface normals of the matched points; and

minimizing the deviation between the locations of the matched points.

19. The method as set forth in claim 18, wherein the step of matching includes:

implementing a K-D tree matching algorithm.

20. The method as set forth in claim 19, wherein the deviation minimizing step includes:

utilizing a Levenberg-Marquardt error minimization algorithm.

21. The method as set forth in claim 18, wherein the step of determining the affine transform further includes:

selecting a reduced fraction of points to be matched in the two images.

22. The method as set forth in claim 21, further including:

removing matched pairs of points that fail to meet preselected criteria.

23. The method as set forth in claim 18, further including:

reducing a number of points selectively, non-uniformly by one of prior knowledge and randomly with an oversampling of points for optimizing registration along a direction in which the slice pairs are stepped.

24. The method as set forth in claim 18, wherein:

the step of registering further includes converting the first and second diagnostic images into feature image representations; and

the step of determining the affine transform further includes operating on the first and second feature image representations to determine the affine transform.

25. The method as set forth in claim 24 wherein generating the feature image includes:

segmenting target organs in the diagnostic images; and

extracting a set of features to be matched in the diagnostic image.

26. The method as set forth in claim 25 wherein generating the feature image includes:

segmenting lungs in the diagnostic images to assign tissue on one side of a boundary of an organ of interest a first value and tissue or air on another side of the boundary of the organ of interest a second value, distinct from the first value; and

extracting a boundary layer of voxels of the organ of interest.

27. The method as set forth in claim 26, further including prior to determining the affine transform:

scaling the boundary layer; and

normalizing the boundary layer.

28. The method as set forth in claim 26, further including:

operating on one of the boundary layers with the determined affine transform; and

iteratively determining correction transforms to the affine transform to optimize the affine transform.

29. The method as set forth in claim 26, further including:

combining an operator selected plurality of slices in each of the displayed slice images.

30. The method as set forth in claim 16, further including:

generating a current diagnostic image representation of a region of interest of a patient; and

retrieving a previously generated image representation of the volume of interest of the patient.